CLAIMS

What is claimed is:

1. A system for interacting with targeted tissue of a patient, the system comprising:

a central control module adapted for subcutaneous implantation;

a satellite module adapted for subcutaneous implantation coupled to said central control module, said satellite module comprising:

a processor;

a communication module coupled to said processor for communicating with said central control module;

a switching module coupled to said processor;

a memory coupled to said communication module and said processor;

a sense amp;

an A/D converter coupled to said sense amp and said memory;

a lead adapted for subcutaneous implantation coupled to said sense amp and said switching module, said lead having at least one tissue interaction element.

2. The system for interacting with targeted tissue of a patient as recited in claim 1 wherein the central control module includes a power source for providing power to the satellite module.

3. The system for interacting with targeted tissue of a patient as recited in claim 2 wherein the central control module further includes a transceiver module for communicating to a programmer.

4. The system for interacting with targeted tissue of a patient as recited in claim 3 wherein the central control module further includes a communication module coupled to the power source and the satellite module wherein communication between the central control module and the satellite module is combined with power delivery to minimize interconnections.

5. The system for interacting with targeted tissue of a patient as recited in claim 4 wherein the central control module is limited to providing power to the satellite module and acting as a communication hub of the system.

6. The system for interacting with targeted tissue of a patient as recited in claim 1 wherein the satellite module includes a signal generator coupled to the switching module for generating a therapy stimulation signals for the targeted tissue.

7. The system for interacting with targeted tissue of a patient as recited in claim 1 wherein the satellite module further includes:

a logic block coupled to the switching module; and

a buffer coupled to the logic block and the memory.

8. The system for interacting with targeted tissue of a patient as recited in claim 1 wherein the central control module and satellite module is limited to two wire interconnections for providing power and communication.

9. The system for interacting with targeted tissue of a patient as recited in claim 1 wherein the central control module and satellite module is limited to four wire interconnections for providing power, communication, and stimulation signals.

10. The system for interacting with targeted tissue of a patient as recited in claim 1 wherein control of a therapy stimulation signals to the targeted tissue of a patient is controlled by the satellite module.

11. A system for interacting with targeted tissue of a patient, the system comprising:

a central control module; and

a satellite module coupled to the central control module placed in proximity to the targeted tissue wherein the satellite module includes:

a hybrid circuit substrate;

at least one integrated circuit mounted on an upper surface of the hybrid circuit substrate;

at least one via through the hybrid circuit substrate wherein the at least one integrated circuit couples to the at least one via at the upper surface of the hybrid circuit substrate;

at least one lead adapted for subcutaneous implantation coupled to said at least one via at a bottom surface of the hybrid circuit substrate, the at least one lead having at least one tissue interaction element; and

a cover hermetically sealed to an upper surface of the hybrid circuit substrate covering the at least one integrated circuit and the at least one via.

12. The system for interacting with targeted tissue of a patient as recited in claim 11 further including at least one contact on the upper surface of the hybrid circuit substrate wherein a portion of the at least one contact is outside the cover and wherein the at least one contact is coupled to the at least one integrated circuit.

13. The system for interacting with targeted tissue of a patient as recited in claim 12 wherein the hybrid circuit substrate comprises a ceramic material.

14. The system for interacting with targeted tissue of a patient as recited in claim 13 further including a dielectric layer between the cover and the at least one contact and wherein the at least one contact couples to a lead adapted for subcutaneous implantation having at least one tissue interaction element.

15. The system for interacting with targeted tissue of a patient as recited in claim 14 wherein wiring between the central control module and the satellite module is limited to two wires and wherein the two wires are used to provide power from the central control module to the satellite module and bi-directional communication between the central control module and the satellite module.

16. The system for interacting with targeted tissue of a patient as recited in claim 14 wherein wiring between the central control module and the satellite module is limited to four wires or less.

17. A method of communicating between a central control module and a satellite module for interacting with targeted tissue of a patient comprising the steps of:

providing a programming word comprising information to be sent to the satellite module;

converting the programming word into identifiable groups of pulses corresponding to bits of the programming word;

sending the identifiable groups of pulses to the satellite module;

converting the identifiable groups of pulses in the satellite module to information for providing a therapy to the patient; and

storing the energy from the identifiable groups of pulses to power the satellite module.

18. The method of communicating between a central control module and a satellite module for interacting with targeted tissue of a patient as recited in claim 17 wherein the step of providing a programming word comprising information to be sent to the satellite module further including the steps of:

beginning the programming word with a plurality of bits identifying a start of the programming word;

following the plurality of bits identifying the start of the programming word with a plurality of information bits; and

ending the programming word with a cyclic redundancy code (CRC).

19. The method of communicating between a central control module and a satellite module for interacting with targeted tissue of a patient as recited in claim 18 wherein the step of following the plurality of bits identifying the start of the programming word with a plurality of information bits further including the steps of:

providing a plurality of bits corresponding to a module address; and

providing a plurality of bits corresponding to electrode settings.

20. The method of communicating between a central control module and a satellite module for interacting with targeted tissue of a patient as recited in claim 19 further including the steps of:

receiving the cyclic redundancy code at the satellite module;

applying a polynomial to the received information to generate a data check word;

comparing the cyclic redundancy code against the data check word; and

identifying to the central control module whether the information was sent correctly.

21. The method of communicating between a central control module and a satellite module for interacting with targeted tissue of a patient as recited in claim 17 further including the steps of:

providing X bits of the programming word;

reading the X bits as a corresponding decimal equivalent;

sending a number of pulses equal to the corresponding decimal equivalent;

providing a predetermined delay; and

repeating said steps of providing X bits of the programming word, reading the X bits as a decimal equivalent, sending a number of pulses equal to the corresponding decimal equivalent, and providing a predetermined delay until all bits of the programming word have been converted and sent.

22. A method of operating a system for interacting with targeted tissue of a patient, the system includes a central control module and a satellite module both adapted for subcutaneous implantation, the satellite module being placed in proximity to the targeted tissue, the method comprising the steps of:

sensing analog signals from electrodes coupled to the targeted tissue;

amplifying the analog signals in the satellite module;

converting the analog signals to digital words;

storing the digital words in memory on the satellite module;

processing the digital words in the satellite module;

generating a therapy from analysis of the digital words in the satellite module; and

implementing the therapy.

23. The method of operating a system for interacting with targeted tissue of a patient, the system includes a central control module and a satellite module both adapted for subcutaneous implantation, the satellite module being placed in proximity to the targeted tissue as recited in claim 22 further including the steps of:

storing in memory information received from more than one electrode;

sending the information from the more than one electrode to the central control module; and

sending the information from the more than one electrode by radio frequency transmission from the central control module to a programmer.

24. The method of operating a system for interacting with targeted tissue of a patient, the system includes a central control module and a satellite module both adapted for subcutaneous implantation, the satellite module being placed in proximity to the targeted tissue as recited in claim 23 further including the steps of:

analyzing the information;

sending a modification to the therapy by radio frequency transmission from the programmer to the central control module;

sending the modification to the therapy from the central control module to the satellite module;

storing the modification to the therapy in the satellite module; and

implementing the modification to the therapy.